

EXHIBIT E

Rebuttal Report of Blakeman B. Esselstyn

I. INTRODUCTION

1. My name is Blakeman B. Esselstyn, and I am the founder and principal of a consultancy called Mapfigure Consulting. I submitted an expert report on May 31st, 2024, which includes information about my qualifications. Since that time, I have taken on two new public redistricting projects and one new public speaking engagement related to redistricting, which are reflected in the updated version of my Curriculum Vitae, provided as **Attachment A**.

2. I was asked by counsel to review the Expert Report of Dr. Sean P. Trende (dated August 16, 2024) and provide my analysis and conclusions. In addition to the report document, I received “production” files both from Dr. Trende’s recent report and from work he evidently did during the preliminary injunction phase. These files include demographic and geographic data, R programming code, and a block equivalency file, as well as the reports to which he was responding and backup materials for those. Details about software and data I used, the methodology of my analysis, and other tools used in making the graphics in this report are provided in **Attachment B**.

3. In my initial report, I relied on calculations from the U.S. Census Bureau’s 2020 citizen voting age population (CVAP) special tabulation for North Carolina from the American Community Survey (ACS) 5-Year Estimates (2016-2020), which were available disaggregated to the census block level from the Redistricting Data Hub. As Dr. Trende notes on page 23 of his report, on June 24, 2024, the Redistricting Data Hub made available disaggregated data from the Census Bureau’s 2022 CVAP tabulation,

which reflects 5-year estimates from 2018 to 2022.¹ The dataset allows me to update the CVAP numbers and percentages presented in my earlier report, and the first section of this report will provide those updates.

4. The Black CVAP percentages in my Demonstration Districts B and D are lower using the updated 2022 tabulation than they were using the 2020 tabulation. The Black CVAP percentage for Demonstration District D using the 2022 tabulation is 50.14%. In the case of Demonstration District B, however, the Black CVAP percentage is 49.41%—below 50%—using the 2022 tabulation. Accordingly, I present an additional Demonstration District E, which is a majority-Black State Senate district—with a Black CVAP above 50% using the 2022 tabulation—that can be created wholly within the outer boundary of current Senate Districts 1 and 2.

5. It is my understanding that another expert, Dr. Loren Collingwood, is also reviewing Dr. Trende's Report and will respond to Dr. Trende's analysis of CVAP margin of error. As such, my review does not include an independent calculation of estimated error margins. Similarly, it is my understanding that Dr. Jonathan C. Mattingly will be considering Dr. Trende's use of the *Stephenson* algorithm software code that Dr. Mattingly presented as part of his earlier expert report, so my review does not cover that particular topic.

6. My conclusions can be summarized as follows:

¹ See <https://redistrictingdatahub.org/dataset/north-carolina-cvap-data-disaggregated-to-the-2020-block-level-2022/>

- a. Dr. Trende does not dispute that my Demonstration Districts A and C are majority-Black districts (with BVAP over 50%) that are reasonably configured, that comport with traditional redistricting criteria, and that are significantly more compact than the districts enacted in 2023 that are most analogous to them.
- b. Based on the newly available 5-year 2022 CVAP data, Demonstration District D has a Black CVAP percentage of 50.14%; Demonstration District B has a Black CVAP percentage of 49.41%—below 50%. Demonstration District E has a Black CVAP percentage of 50.74%.
- c. Using the most up to date CVAP numbers, it is still possible to create an additional majority-Black State Senate district in northeastern North Carolina that is reasonably configured and does not require altering the boundaries of any existing Senate district other than Districts 1 and 2. Demonstration District D and Demonstration District E are examples of such districts. In addition, Demonstration District E's Black CVAP percentage is greater than 50% at both the 90% and 95% confidence interval after accounting for the margin of error associated with CVAP estimates.
- d. Dr. Trende's analysis contains inaccurate statements, erroneously reported numbers, computational errors, flawed logic, misleading maps, incorrect racial categorizations, and questionable attribution of sources. These missteps affect the soundness of his opinions, particularly with

regard to demographic findings, error estimation, and North Carolina's *Stephenson* requirements.

II. UPDATED CALCULATIONS USING 2022 CVAP DATA

7. In creating this report, as well as my May 31st report, I relied on datasets from the U.S. Census Bureau known as the Citizen Voting Age by Race and Ethnicity (CVAP) special tabulation based on American Community Survey 5-year estimates.² These data are considered the authoritative source for analysis like mine looking at race and/or ethnicity as well as citizenship. These data don't offer the same level of granularity or precision as the data from the decennial census (which offers no citizenship information), but they are considered the best available for this purpose and are widely used.

8. Since these CVAP data aren't provided at the precinct level (unlike the data from the decennial census), I also rely on a derived dataset, produced by the Redistricting Data Hub (also known as RDH), which disaggregates the CVAP data from the Census Bureau's block group level down to the individual block level.³ On June 24, 2024, several weeks after I submitted my earlier report, RDH published their block level dataset based on the 2022 5-year estimates (from the years 2018–2022). This RDH product (available for other states as well) is the only such publicly available, well-documented block level CVAP disaggregation dataset of which I am aware, and it is used by other analysts—including Dr. Trende. Many other products from RDH are also relied

² See <https://www.census.gov/programs-surveys/decennial-census/about/voting-rights/cvap.html>

³ These block level data can then be re-aggregated to the precinct level.

upon by redistricting practitioners in government, academia, the non-profit sector and the consulting sector.

9. Using this more current dataset, I have updated the Black CVAP numbers I provided in my May 31st report, both for enacted districts and demonstration districts. Below, I provide updated versions of tables in my initial report that reflect Black CVAP values using the 5-year 2022 ACS data instead of the 5-year 2020 ACS data. The table marked 1a corresponds to the table marked 1 in my original report, and so on.

Table 1a: Statistics for selected districts in enacted 2022 NC Senate Plan

District	Population Deviation	BVAP	2022 Black-CVAP	Reock	Polsby-Popper
SD 1 (Carteret, Pamlico, Hyde, Dare, Washington, Chowan, Perquimans, & Pasquotank Counties)	-4.33%	17.47%	17.86%	0.40	0.18
SD 3 (Warren, Halifax, Northampton, Martin, Bertie, Hertford, Gates, Camden, Currituck, & Tyrrell Counties)	-4.96%	42.33%	43.26%	0.30	0.17
SD 4 (Wayne, Wilson, & Greene Counties)	+3.73%	35.02%	36.84%	0.57	0.41
SD 5 (Edgecombe & Pitt Counties)	+4.96%	40.35%	40.50%	0.40	0.34
SD 9 (Bladen, Duplin, Pender, and Jones Counties & a portion of Sampson County)	-2.87%	23.92%	25.37%	0.44	0.23
SD 11 (Vance, Franklin, & Nash Counties)	-1.28%	36.65%	38.78%	0.46	0.38

Table 2a: Statistics for selected districts in enacted 2023 NC Senate Plan

District	Population Deviation	BVAP	2022 Black-CVAP	Reock	Polsby-Popper
SD 1 (Northampton, Hertford, Bertie, Gates, Perquimans, Pasquotank, Camden, Tyrrell, Currituck, & Dare Counties)	-4.39%	29.49%	30.14%	0.26	0.21
SD 2 (Warren, Halifax, Martin, Washington, Chowan, Hyde, Pamlico, & Carteret Counties)	-4.90%	30.01%	30.71%	0.23	0.10
SD 4 (Wayne, Wilson, & Greene Counties)	+3.73%	35.02%	36.84%	0.57	0.41
SD 5 (Edgecombe & Pitt Counties)	+4.96%	40.35%	40.50%	0.40	0.34
SD 9 (Bladen, Duplin, Pender, & Jones Counties & a portion of Sampson County)	-2.87%	23.92%	25.37%	0.44	0.23
SD 11 (Vance, Franklin, & Nash Counties)	-1.28%	36.65%	38.78%	0.46	0.38

Table 3a: Statistics for Demonstration District A

District	Population Deviation	BVAP	2022 Black-CVAP	Reock	Polsby-Popper
Demonstration District A	-4.29%	51.47%	52.71%	0.30	0.32

Table 4a: Statistics for additional districts in Demonstration Map A

District	Population Deviation	BVAP	2022 Black-CVAP	Reock	Polsby-Popper
A-2	-2.00%	17.31%	18.05%	0.43	0.33
A-4	+0.19%	33.42%	35.81%	0.39	0.21
A-9	-2.99%	19.93%	20.31%	0.33	0.14
A-11	-0.62%	33.58%	35.80%	0.59	0.38

Table 5a: Statistics for Demonstration Districts B and B-2

District	Population Deviation	BVAP	2022 Black-CVAP	Reock	Polsby-Popper
Demonstration District B	-4.93%	48.41%	49.41%	0.35	0.29
Demonstration District B-2	-4.36%	11.37%	11.88%	0.39	0.25

Table 6a: Statistics for Demonstration District C

District	Population Deviation	BVAP	2022 Black-CVAP	Reock	Polsby-Popper
Demonstration District C	-2.08%	50.21%	51.24%	0.37	0.36

Table 7a: Statistics for additional districts in Demonstration Map C

District	Population Deviation	BVAP	2022 Black-CVAP	Reock	Polsby-Popper
C-2	+3.81%	13.49%	13.81%	0.37	0.32
C-4	-4.11%	36.51%	38.27%	0.49	0.32
C-11	-4.46%	32.52%	35.07%	0.33	0.23

Table 8a: Statistics for Demonstration Districts D and D-2

District	Population Deviation	BVAP	2022 Black-CVAP	Reock	Polsby-Popper
Demonstration District D	-4.67%	49.22%	50.14%	0.30	0.21
Demonstration District D-2	-4.62%	10.50%	11.06%	0.34	0.17

10. For additional CVAP statistics related to the districts listed above, as well as the districts in Demonstration Map E, please see **Attachment C**.

11. One value that changes when using the newer data is the Black CVAP percentage for Demonstration District B. The updated value is 49.41%—not over 50%—so I no longer offer that district as a majority-Black district.

12. Other characteristics of the districts, like their spatial configurations, are not at all altered by substituting the newer data from this one demographic category (i.e., CVAP). In particular, I remark that, for Demonstration Maps A, B, C, and D, out of 50 districts the numbers of districts that are unchanged from the currently enacted State Senate plan are still 45, 48, 46, and 48 respectively. Out of the 26 *Stephenson* county groupings used in the currently enacted plan, the number of groupings that are unchanged in Demonstration Maps A, B, C, and D are 21, 24, 22, and 24 respectively.⁴

III. DEMONSTRATION DISTRICT E

13. Although Demonstration District D continues to have a Black CVAP above 50% when using the 2022 CVAP data, its CVAP percentage decreases from 50.81% (using the 2020 CVAP data) to 50.14%. Dr. Trende's report offers the opinion that, because CVAP data reported by the Census Bureau contains a margin of error, it is inappropriate to rely on Black CVAP estimates unless those estimates are above 50% when accounting for the margin of error. Dr. Trende does not dispute that CVAP data from the most recent 5-year American Community Survey compilation is the best

⁴ One of the groupings that changes in Demonstration Map A is a two-district grouping in which only one of the districts changes. The SD 12 in Demonstration Map A, which occupies all of Lee and Harnett Counties and a portion of Sampson County, remains identical to the enacted SD 12.

available data source for calculating a demonstrative district's Black CVAP percentage, and I believe it is reasonable to rely on this data to calculate the Black CVAP of a demonstrative district because this data provides the best evidence of Black CVAP (and the only evidence from any official government source).

14. Nonetheless, and in light of the fact that Demonstration District D's Black CVAP decreased using the 2022 ACS data, I have created a Demonstration District E and Demonstration Map E to respond to Dr. Trende.

15. Demonstration District E is composed of Bertie, Gates, Halifax, Hertford, Martin, Northampton, Tyrrell, Warren, and Washington Counties in their entirety and a portion of Pasquotank County. The BVAP for the district is slightly less than 50%, but the Black CVAP using 2022 ACS data is 50.74%.

16. It is my understanding that Dr. Mattingly has confirmed that the *Stephenson*-compliant county groupings based on Demonstration District E contain only one change from the groupings used in the enacted maps, namely substituting one two-district cluster for the two one-district cluster options that contain existing Senate Districts 1 and 2. Consequently, I only needed to design one other district to accompany Demonstration District E. This district, which I will call District E-2, is in accordance with permissible population deviation and other redistricting standards. Figure 1 below shows the geographic configuration of both districts, which I will call Demonstration Map E, and Table 9 includes relevant statistics for Demonstration District E and E-2. For additional demographic information related to these two districts, please see **Attachment D**.

Figure 1: Demonstration Map E

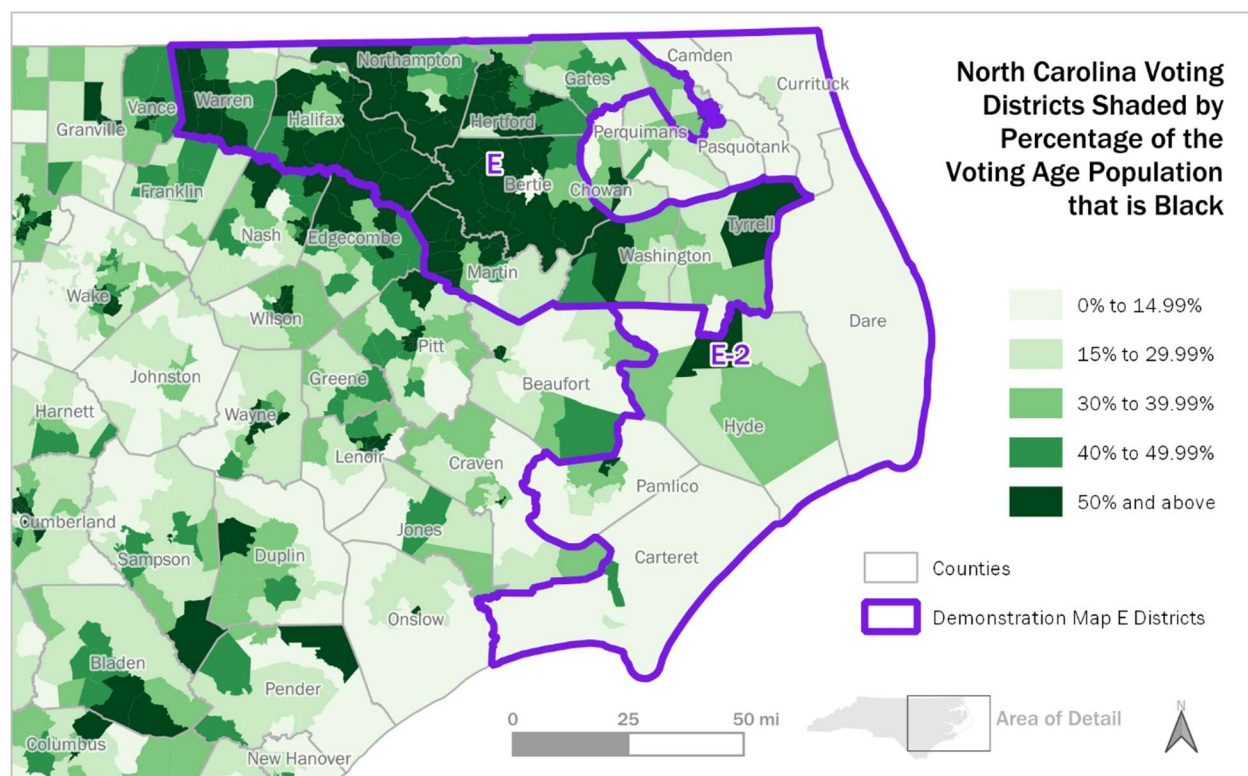


Table 9: Statistics for Demonstration Districts E and E-2

District	Population Deviation	BVAP	2022 Black-CVAP	Reock	Polsby-Popper
Demonstration District E	-4.66%	49.64%	50.74%	0.30	0.21
Demonstration District E-2	-4.63%	10.08%	10.54%	0.34	0.17

17. The compactness scores for Demonstration Map E districts are as high or higher than those for the corresponding districts in the enacted Senate map for 2023, as shown in Table 10 below. (For additional documentation about the measures of compactness, please see **Attachment E**.) The districts are contiguous, and the population of both districts is at or within plus or minus five percent of the ideal district population. As I noted in my initial report, northeastern North Carolina’s Black Belt counties can be considered a significant community of interest, and Demonstration

District E keeps more of that community intact than do the districts in either of the recently enacted plans.

Table 10: Compactness score comparison for Demonstration Map E

Demonstration Districts	E	E-2	Average
Reock	0.30	0.34	0.32
Polsby-Popper	0.21	0.17	0.19
Enacted 2023 Districts	1	2	Average
Reock	0.26	0.23	0.25
Polsby-Popper	0.21	0.10	0.16

18. Turning to existing political subdivisions, Demonstration Map E is comparable to the enacted 2023 map. Demonstration Map E divides one more county than the enacted map. Although Demonstration District E divides three VTDs, only one of those VTD divisions divides any population; the other two VTD divisions involve wholly unpopulated stretches of water in the Pasquotank River. Notably, as the General Assembly’s “StatPack” indicates, 14 of the 50 districts in the 2023 enacted Senate plan divide VTDs, and two of those districts divide three VTDs.⁵ Demonstration Map E, like Demonstration Maps B and D, fully preserves 48 of the 50 existing State Senate districts and 24 of the 26 *Stephenson* county groupings currently in use.

19. Demonstration District E also respects the boundaries of Elizabeth City. Demonstration District E contains 100% of the population of Elizabeth City that is in Pasquotank County. (Elizabeth City is split between Pasquotank and Camden County, and Elizabeth City residents in Camden County are accordingly in Demonstration

⁵ This document is available as part of Attachment E in my *previous* report.

District E-2.) For a larger-scale map showing the Elizabeth City area and the Demonstration District E boundaries in that area, please see **Attachment F**.

20. Finally, the Black CVAP% of Demonstration District E is above 50%⁶ using the 2022 ACS data even taking into account the margin of error. I understand from Dr. Collingwood's rebuttal report that Dr. Trende's margin of error calculations are incorrect in multiple respects, and I have relied on Dr. Collingwood's calculation of the margin of error for Demonstration District E's CVAP figures. Dr. Collingwood calculates that the margin of error for the Black CVAP% calculation for Demonstration District E is 0.601% at the 90% confidence level. Thus, one can say with 90% confidence that Demonstration District E's Black CVAP is between 50.14% and 51.34%. The Census Bureau typically uses 90% confidence levels with the ACS data, but even if one considers Dr. Trende's suggestion that the 95% confidence level is the preferred standard, Dr. Collingwood calculates that the margin of error for the Black CVAP% calculation for Demonstration District E is .716% at the 95% confidence level. Thus, one can say with 95% confidence that Demonstration District E's Black CVAP is between 50.02% and 51.46%.

21. Dr. Trende also notes that the Census Bureau publishes ACS data at the block group level, and that calculating CVAP at the block level requires the use of disaggregation techniques that involve estimation. As I noted in my initial report, I have relied on the disaggregation performed by the Redistricting Data Hub, which is a data

⁶ I calculated the Black CVAP percentage using the same method that I used in the original report (and that Dr. Trende uses) for consistency, and also verified that calculating the percentage using the pre-disaggregation county files from the Census Bureau, combined with the disaggregated numbers from RDH for Demonstration District E's split county, does not alter my conclusion that Demonstration District E's Black CVAP is above 50% taking into account the margin of error.

source that is routinely relied on by experts in this field, and Dr. Trende does not suggest that the Redistricting Data Hub is an unreliable source or uses an unreliable method for disaggregating ACS data. Experts in this field routinely rely on ACS data to calculate the Black CVAP of districts, including districts that split block groups, notwithstanding the need to disaggregate the Census's reported data down to the block level.

IV. FINDINGS ABOUT DR. TRENDE'S REPORT

22. In his report responding to both my expert report and Dr. Mattingly's report, Dr. Trende offers opinions about *Stephenson* groupings, use of U.S. Census Bureau data, calculation of error margins, *Gingles* factor one, and demographic patterns within the demonstration districts shown in my report. But Dr. Trende's report contains numerous calculation errors and misstatements that undermine his conclusions.

A. Fundamental errors with interpreting and handling census data

23. Any evaluation of *Gingles* factor one relies heavily on data from the U.S. Census Bureau. Dr. Trende's report includes misstatements about the data as well as repeated mishandling and misinterpretation of them.

24. On page 18, he states, "Beginning with the 2020 census, data at the block level were randomly altered to mask individuals' identities, including racial data." In fact, the modification of granular census data in order to protect privacy was introduced decades before 2020. Efforts at so-called "disclosure avoidance" including "noise

insertion” and other altering of data date back to at least 1990.⁷ In previous decades researchers had been aware of these tweaks to the block level data, and courts have accepted findings based on those data, including for topics like the *Gingles* preconditions.

25. Both the decennial census data (sometimes referred to as the PL 94-171 Redistricting File dataset) and datasets based on the ACS (such as the CVAP special tabulation) use many classifications of race and ethnicity, further separated into listings by total population or adult population. Identifying the right classification or classifications is essential to sound analysis, and there are multiple instances of Dr. Trende failing to do so.

26. Unlike other reports I’ve reviewed related to a *Gingles* factor one analysis, his report doesn’t clarify what he means by “Black” somewhere early in the analysis. My assumption is that the classification he uses is the same as the one I specified (and which I understand to be the accepted standard), but it’s not made clear.

27. One instance of applying the wrong category plays out on pages 16 and 17 of Dr. Trende’s report. The categorizations used to identify Black adults for BVAP are different from those used for Black CVAP. Dr. Trende acknowledges this discrepancy in an error-filled footnote on page 16,⁸ but then on page 17, he proceeds to use the

⁷ See, e.g., <https://www2.census.gov/library/publications/decennial/2020/census-briefs/c2020br-03.pdf> — in particular the “DISCLOSURE AVOIDANCE IS NOT NEW” section on p. 2.

⁸ There are multiple issues with Dr. Trende’s footnote 5 on page 16, which states, “Note that “Black” for purposes of CVAP is defined here as “Black Alone,” “Black or White in combination” or “Black and American Indian.” First, this explanation omits the important distinction that these classifications are under the “Not Hispanic or Latino” category—unlike the standard practice for BVAP. Notably, this means Black CVAP estimates for a district based on the ACS data are likely to understate the true Black CVAP percentage, because citizens of voting age who identify as Black and Hispanic will count towards the calculation of total CVAP, but not Black CVAP. Second, even though he provides these terms within

numbers appropriate for BVAP when he should be using those for Black CVAP. The specific numeric consequences of this misstep are called out in the next subsection.

B. Mishandled evaluation of majority-Black status and error margins

28. A significant portion of Dr. Trende's report is examining the classification of Demonstration Districts B and D as majority-Black districts and the role that error margins might play in making that determination. But key sections outlining his approach and his findings have textual, numerical, and logic errors.

29. On page 10, Dr. Trende states, "We just know that as we keep taking polls, our population value will fall within the confidence interval one time out of ten." Actually, in this context, the opposite is true: the population value should fall *outside* the confidence interval one time out of ten.

30. On page 18, he states, "I will provide the error margins below for all of the Block Groups in the district." I was unable to find any listing of Block Groups or such error margins later in the report, which was unfortunate because a listing of the block groups he considered for his calculations would have allowed me to better understand how he produced results inconsistent with my own on page 23 (which I will explain below).

quotation marks, as if rendered verbatim, all of them don't match the terms in the CVAP documentation, namely "Black or African American Alone," Black or African American and White," and "American Indian or Alaska Native and Black or African American." Third, the wording is important, especially for the second of the three terms; "Black and White" is very different from "Black or White in combination"—the latter would classify all people who identify as partially White as "Black." See p. 3 of https://www2.census.gov/programs-surveys/decennial/rdo/technical-documentation/special-tabulation/CVAP_2018-2022_ACS_documentation_v1.pdf

31. On page 16, Dr. Trende states, “The 90% error margin for the overall estimate is +/- 315 citizens [...],” which is incorrect. He appears to have mistakenly reported the margin of error for the “Not Hispanic or Latino” subset of the CVAP population. The true margin of error for the total CVAP population is ± 313 .⁹

32. As mentioned in the previous subsection, he applies the BVAP classification instead of the Black CVAP classification on page 17, in his attempt to explain the nature of the block group level CVAP data and how it is disaggregated. To disaggregate block group level Black CVAP data, the Redistricting Data Hub attributes a portion of a block group’s Black CVAP to a particular block by calculating (using the decennial, or PL 94-171 data) the proportion of the block group’s Black voting age population that is in the block. But Dr. Trende appears to misunderstand this method for calculating the proportion of the block group’s Black voting age population from the Census. He states, “The block group overall has a VAP of 1212 and a BVAP of 346. Census Block 371399606002000, contained within the block group, has a VAP of 127 and a BVAP of 12. It therefore contains 10.5% of the block group’s VAP and 3.5% of the block group’s BVAP” [my emphasis]. All of the emphasized numbers are incorrect; they should be 338, 11, and 3.3% respectively. He goes astray by using the any part Black BVAP classification from the decennial census, instead of calculating Black voting age population from the decennial census using the three categories that make up the Black CVAP version. These three categories, drawn—unlike the any part Black BVAP—from

⁹ See p. 6-35 of https://www2.census.gov/programs-surveys/decennial/2020/technical-documentation/complete-tech-docs/summary-file/2020Census_PL94_171Redistricting_StatesTechDoc_English.pdf and p. 3 of https://www2.census.gov/programs-surveys/decennial/rdo/technical-documentation/special-tabulation/CVAP_2018-2022_ACS_documentation_v1.pdf as well as the README file referenced in Dr. Trende’s report.

the “Not Hispanic or Latino” subset of the data, are the “Black or African American Alone,” “Black or African American and White,” and “American Indian or Alaska Native and Black or African American” classifications. Although any part Black is the correct category for calculating a total BVAP percentage in a particular district, it is not the correct category for determining how to disaggregate a block group’s Black CVAP number, since Black CVAP does not include people who identify as both Black and Hispanic, and also does not include people who identify as certain multi-racial identities, such as a combination of Black and Asian.¹⁰

33. Also on page 17, Dr. Trende states, “In other words, it is assigned $920 \times .105 = 96$ citizens and $105 \times 0.035 = 3$ Black citizens.” First, the numbers he provides are for Black CVAP, not Black citizens. Second, not only does this statement replicate the inaccurate percentage noted in my previous paragraph (3.5%, here shown in decimal form as 0.035), but there are issues with the arithmetic and failure to report fractional values. In fact, $920 \times .105 = 96.6$, and 105×0.035 [sic] = 3.7. Without explanation, Dr. Trende rounds these results down to 96 and 3, which one might typically expect to get rounded up to the next integer (i.e., 97 and 4). If all such values were simply rounded down, the block values, when added together, would not yield the correct totals for block groups or precincts (or other geographies higher in the census hierarchy for that matter). RDH uses a specialized rounding methodology to address this important step in the process, a methodology in fact described in the CVAP README file that Dr. Trende references in his report. It’s not as simple as rounding down every time. By

¹⁰ The same documents referenced in the previous footnote are instructive for this miscategorization instance as well.

failing to include an explanation of this step, someone trying to replicate this process would end up with numbers that would cause accuracy problems when aggregated.

34. Later on page 17, he states, “In other words, while Census Block 371399606002000 may have exactly 3.5% of the block group’s total VAP, it doesn’t necessarily follow that it will have exactly 3.5% of the block group’s total CVAP.” In fact, Census Block 371399606002000 has 10.5% of the block group’s total VAP: as Dr. Trende reports earlier on that same page, that block has a VAP of 127 and is within a block group with a VAP of 1,212.

35. On page 23, Dr. Trende states that, using 2020 data, “The total estimated CVAP for the block groups in district B-1 is 169,225. The total estimated Black CVAP for the block groups in district B-1 is 83,992.” These numbers—which are also critical to Dr. Trende’s calculations of margins of error—are incorrect. Using the 2020 data, the total CVAP for block groups that are contained in Demonstration District B (which Dr. Trende refers to as B-1) is 167,315 and the Black CVAP is 83,542. The “overall Black CVAP %” for these block groups, which he reports on page 24 as 49.6%, should be 49.93%. (Note that these are not calculations of the Black CVAP% of the demonstration district itself, but of a different geographic combination on which Dr. Trende relies.)

36. On page 24, Dr. Trende provides similar analysis for Demonstration District D. Here he doesn’t provide the population tallies for block groups, so I can’t try to replicate those. But his calculations of the Black CVAP percentages for the block groups in Demonstration District D are incorrect. He reports that the block groups have a Black CVAP of 50.2% (using 2020 data) and 49.5% (using 2022 data), when in fact they have a

Black CVAP of 50.55% (using 2020 data) and 49.81% (using 2022 data). My understanding is that Dr. Collingwood has reviewed the R code that Dr. Trende provided that produced these figures and has concluded that Dr. Trende made a very basic error: he misidentifies the block groups that are included in Demonstration Districts B and D, rendering numbers in his report related to margins of error and estimated Black CVAP in those Demonstration Districts wrong and unreliable.

37. On page 25, Dr. Trende tries to make a mathematical argument for why “all counties in the map are required to achieve a majority Black district” in Demonstration District A. If one assumes that by “in the map” he means in the district, perhaps at first blush his assertion about the significance of “2,364 Black residents of voting age” might seem like a reasonable proposition. But his logic assumes that the denominator of the fraction determining BVAP percentage stays unchanged, even if people are being removed from the district, when in fact removing people from the district would affect both numerator and denominator. Properly analyzed, not “all counties [...] are required”—a design with Chowan or Gates County substituted for Washington County would also exceed the 50% threshold. His further assertion that only certain specified precincts could be removed (which he states without support) is easily disproved, as there are counterexamples in Hertford and Bertie Counties of other precincts that could be removed while preserving the BVAP majority.¹¹

¹¹ Please see documentation in **Attachment G**.

C. Inaccurate information related to *Stephenson* requirements

38. Dr. Trende's report also includes analysis and conclusions related to the *Stephenson* requirements, but his writing and maps reveal misunderstandings and mischaracterizations about the subject.

39. Page 25 includes the text "If counties were to be split, which I understand to violate the *Stephenson* rule [...]." While working as a redistricting consultant in North Carolina, I have often encountered the misconception that the *Stephenson* decision simply requires the absolute minimization of county splits in the drawing of legislative districts. Rather, the *Stephenson* decision describes a multi-step process which, in the words of a document that was shared by the General Assembly on its website, prescribes, "First, [...] draw the districts required by the Voting Rights Act"—commonly referred to as the VRA.¹² The instructions related to grouping counties are to be followed only after the creation of VRA-compliant districts. Further, as Dr. Mattingly and his colleagues have demonstrated, even independent of VRA considerations, the *Stephenson* process does not necessarily minimize the number of county splits.¹³ Dr. Trende's suggestion that dividing a county is necessarily inconsistent with *Stephenson* misleads the reader.

40. On page 41, Dr. Trende states, "The current *Stephenson* county groupings for North Carolina are depicted below," referring to his Figure 24. I take this statement to mean that the figure should provide an image of the groupings used in the most

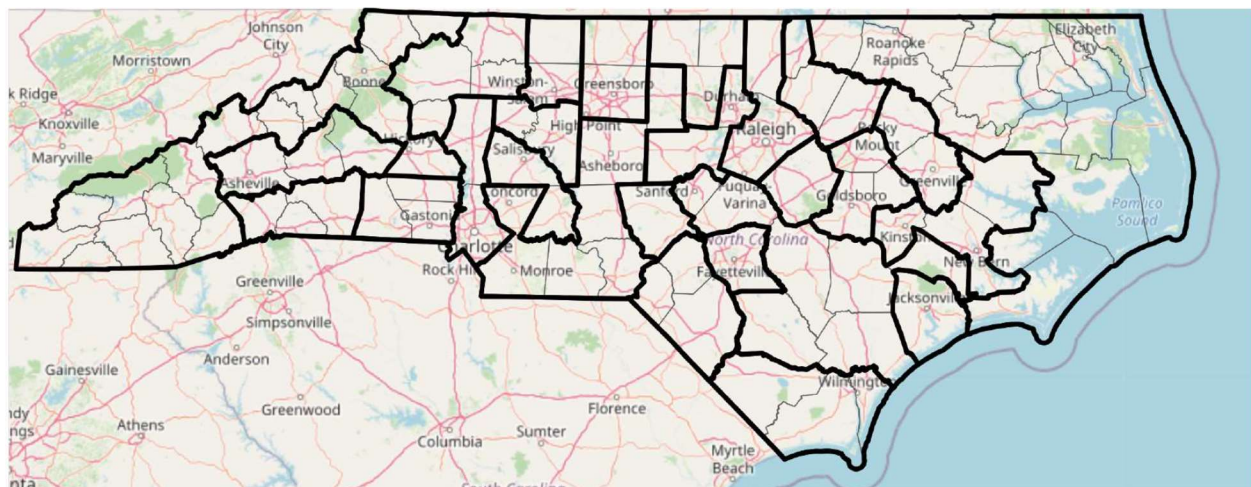
¹² See <https://web.archive.org/web/20171107233448/http://www.ncleg.net/representation/Content/Overview.aspx>

¹³ See <https://www.tandfonline.com/doi/full/10.1080/2330443X.2020.1748552#d1e712>

recently enacted Senate districting plan (which is actually just one out of 16 possible collections of groupings that the General Assembly could have chosen to use in this current decade). But his Figure 24 does not in fact accurately reflect any grouping collections chosen by the General Assembly (since their 2022 enacted plan groupings were slightly different than the ones used in 2023), nor any one that they would have had the option to choose.

41. The map in Dr. Trende's Figure 24 on page 42, reproduced below in my report in Figure 2 shows one large county grouping incorporating much of the northeastern part of the state. But that area should be occupied by one of two possible groupings, as shown in Figure 3 in my earlier report. And these particular groupings are especially relevant as the region they cover includes an area at least partially included in all of my *Gingles* demonstration districts. Dr. Trende doesn't explain the source of this map, but whatever the source, it doesn't represent what he says it does.

Figure 2: Dr. Trende's Figure 24 (reproduced)



42. Dr. Trende's Figure 25 on page 43 also depicts groupings incorrectly. Washington County should be grouped with the counties to its west, not the counties to

its east. This configuration would not accommodate Demonstration District A, which it is purportedly based on. Contrast Dr. Trende's map with Dr. Mattingly's statewide map shown in the "DEMONSTRATION DISTRICT A" section on page 6 of his May 31 report.

D. Flawed assertions about geographic distribution of race

43. Earlier in this report I pointed out Dr. Trende's misapplications of census racial and ethnic categories. In addition to those, Dr. Trende applies unsound logic and mapping designs in his efforts to draw conclusions about where on the map key demographics are located.

44. In the words of noted statistician Edward Tufte, "At the heart of quantitative reasoning is a single question: *Compared to what?*"¹⁴ If one is trying to understand where or whether the Black voting age population constitutes a majority, the appropriate comparators are either the entire voting age population (as a denominator to determine a percentage) or the voting age population which does not identify as Black (to see which is more numerous). The latter group, sometimes referred to as "no part Black," includes 31 possible classifications of single-race or multi-racial identities.¹⁵ Dr. Trende, however, in a number of his maps and explanations, uses the comparator of the White voting age population, as if people who don't identify as Black must be White.¹⁶

¹⁴ Edward Tufte, *Envisioning Information*, Graphics Press, Cheshire, CT, 1990, p. 67.

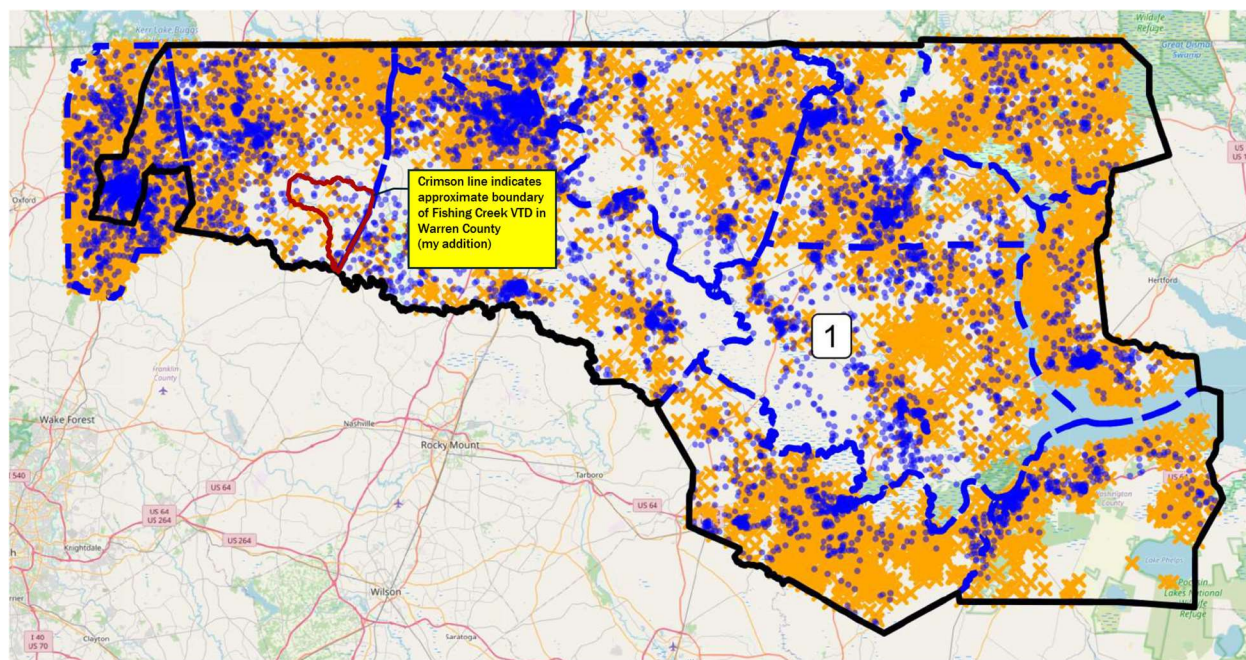
¹⁵ See https://www2.census.gov/programs-surveys/decennial/2020/technical-documentation/complete-tech-docs/summary-file/2020Census_PL94_171Redistricting_StatesTechDoc_English.pdf pages 6-32 through 6-35.

¹⁶ Mention of the racial category "White" essentially doesn't appear in my previous report's *Gingles* factor one analysis. There is one mention in an early paragraph related to demographic trends since 2010 (p. 4), and one footnote where "White" is referenced as a component of a multi-racial classification of Black people (p. 14).

45. Dr. Trende's six "dotplot" maps provide symbols to represent Black people and to represent White people—no other groups.

46. Consider, for example, Fishing Creek precinct in Warren County, an area which looks majority-Black in Dr. Trende's dot density maps. See Figure 3 below. Black people do outnumber White people, but the majority of the voting age population actually identifies as Native American, so Black people are not the majority in that precinct.¹⁷

Figure 3: Dr. Trende's Figure 23 with Fishing Creek precinct boundary



47. On page 27, in the context of choropleth map description showing percentages, Dr. Trende states, "A VTD with 10 Black residents and 10 White residents

¹⁷PL 94-171 table P3 for this VTD (37185000008) lists the Total VAP as 1,274; the White VAP as 112; the any part Black VAP (summed fields) as 529; and the any part American Indian and Alaska Native (summed fields) as 642. See [https://data.census.gov/table/DECENNIALPL2020.P3?g=7000000US37185000008&y=2020&d=DEC%20Redistricting%20Data%20\(PL%2094-171\)](https://data.census.gov/table/DECENNIALPL2020.P3?g=7000000US37185000008&y=2020&d=DEC%20Redistricting%20Data%20(PL%2094-171))

is treated the same as a VTD with 1,000 Black residents and 1,000 White residents.” But what if the first VTD also has 20 Native Hawaiian/Pacific Islander residents?

48. Or consider the one block that his report pays the most attention to, in Pasquotank County (p.17). He mentions the Black CVAP population, but in this block the estimated Asian CVAP population is more than four times more numerous.¹⁸

49. On page 36, he says, “[...] we can [...] better see the distribution of residents using dot density maps.” Given the categories of people who are shown in the maps, I would posit that the sentence should read “[...] we can [...] better see the distribution of the Black and White residents using dot density maps”— not the entire population. Further, choices made in the design of those maps result in distortions of the demographic distribution picture that severely reduce their credibility.

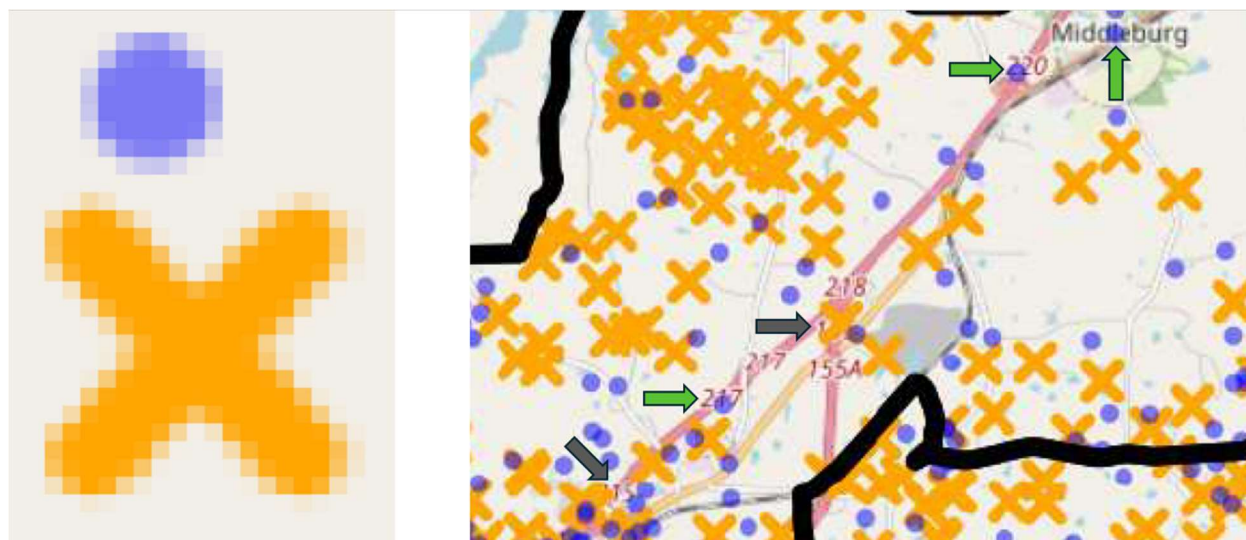
50. In Dr. Trende’s dot density maps, the symbols used to represent the Black and White populations are not treated equally—not even close. Usually in dot density maps, as the name suggests, the entities being shown are represented by dots. But Dr. Trende chooses to use an ‘x’ symbol for White adults, and that ‘x’ symbol renders significantly larger than the dot for Black adults (see zoomed in detail on left in Figure 4 below).¹⁹ By my very conservative pixel count, the ‘x’ occupies at least 3.4 times the area that the dot does—in other words, by pixel count, each Black adult (or collection of ten

¹⁸ The record for block 371399606002000 in the nc_cvap_2022_2020_b.csv file provided with Dr. Trende’s report shows a Black CVAP value of 3, and an Asian CVAP value of 13.

¹⁹ One might think that perhaps colorblindness is a reason for having different symbols, but orange and blue are almost always distinguishable, even by people with color vision deficiencies. See <https://venngage.com/blog/color-blind-friendly-palette/#color-blind-friendly> If there is a concern about legibility in black and white photocopies (unlikely in 2024, but possible) the mapmaker can use the same symbol, but rotated.

Black adults) in Dr. Trende’s dot density maps is depicted as no more than 29% the size of a White adult (or collection of ten White adults).²⁰

Figure 4: Details from Dr. Trende Figure 23 (arrows added)



51. The “Pierce Script.R” code reveals that Dr. Trende chose other diverging settings for the symbols, too. He set the dots to be 50% transparent, but the ‘x’ symbols are entirely opaque. On the right side of Figure 4 above, one can see how the underlying basemap labels can be seen through the blue dots (indicated by green arrows), but the labels are obscured by the ‘x’ symbols (indicated by dark gray arrows). Further, the ‘x’ symbols are assigned a “stroke” value of one, while the dots get a “stroke” value of zero. The R code reference document²¹ says one can “[u]se the stroke aesthetic to modify the width of the border.”²²

²⁰ Using a PDF provided by counsel, I zoomed in on Dr. Trende’s Figure 23 to 6400% magnification and counted pixels. Counting every pixel with any trace of blue I tallied 60. Counting orange pixels, but omitting the lightest shades from my count, I counted 204. $204 \div 60 = 3.4$.

²¹ See https://ggplot2.tidyverse.org/reference/geom_point.html

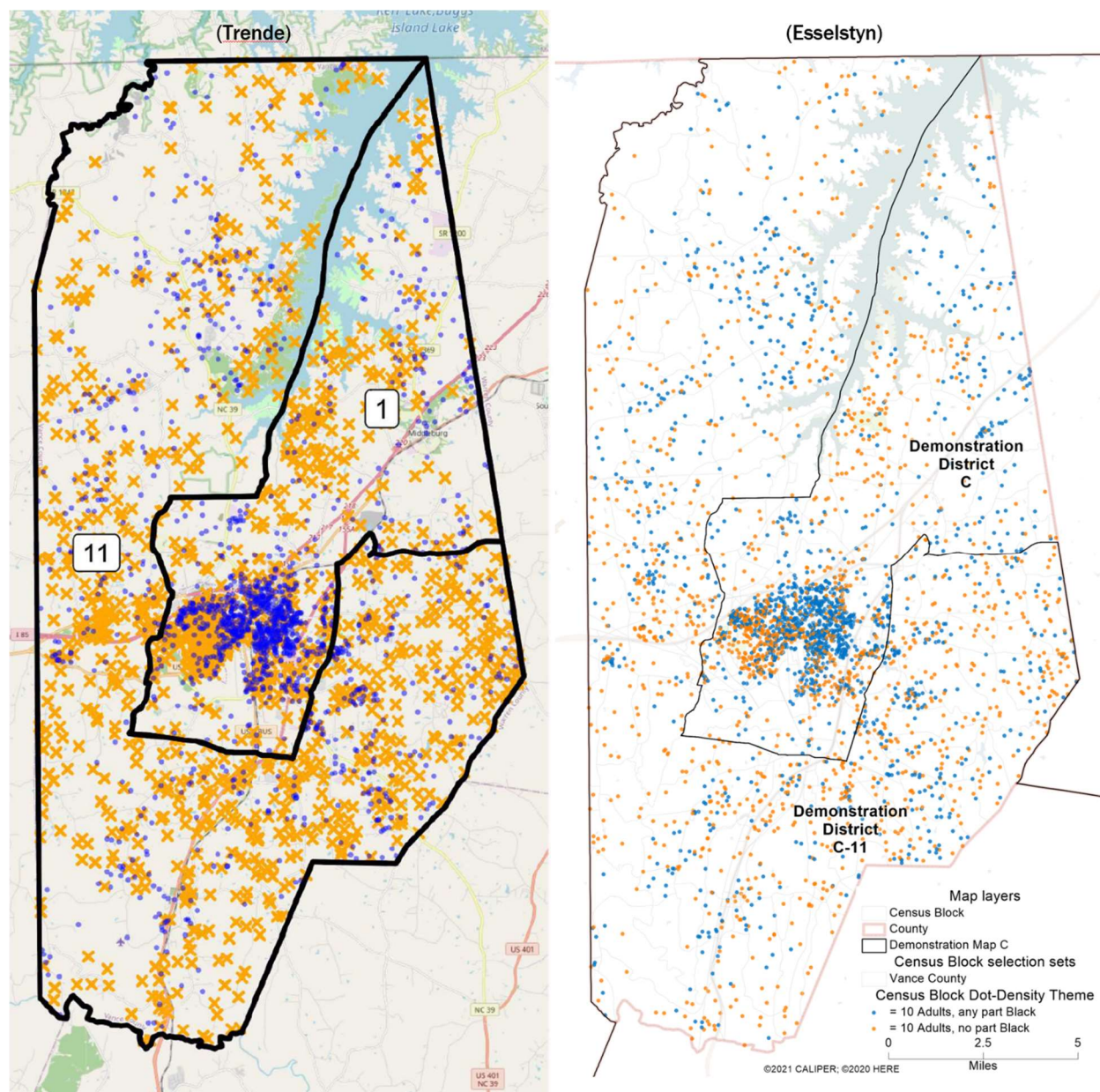
²² Further, in three of his “dotplot” Figures (10, 13, and 20), Dr. Trende displays county lines in what appears to my eye to be a matching shade of blue *on top of* the other symbols, obfuscating data points, and making it hard to discern where the county lines are. Can you confidently identify and trace all the county boundaries in the map reproduced in Figure 2 above? I can’t.

52. The end result of these choices? In these maps the White population is made to have a much more significant visual presence than equal amounts of Black population.

53. One might claim that the dots representing Black population needed to be semi-transparent because they were drawn on top of the ‘x’ symbols. But this very sequential drawing (or “stacking” hierarchy of the symbol layers) is an ill-advised practice, as the top layer can obscure the layer beneath, concealing the diversity in a densely populated area. Mapping software allows for the different dots or symbols to be drawn within the same layer. In Figure 5 below, I present the map from Dr. Trende’s Figure 23 (at left) next to a dot density map of the same area that I made (at right) using Maptitude for Redistricting software.²³ Note that in the denser areas the dots are interspersed, much like people themselves in diverse neighborhoods. Dr. Trende’s combined cartographic choices thus give the impression of a different fraction of the White population in the demonstration districts than is actually the case, as well as a Black population that is more monolithic in small, dense clusters.

²³ In keeping with the argument I made earlier (see paragraph 44), I did use “any part Black” as the classification to be mapped with the blue dots, and “no part Black” to be mapped for the orange dots. This choice should actually have resulted in more *orange* dots than Dr. Trende’s choice of classification, i.e., “White.”

Figure 5: Comparison of two dot density maps by different mapmakers



54. The map I made, where the dot symbols were handled identically in every respect other than color, provides a different impression than Dr. Trende's map about the relative presence of the Black voting age population in the area in and outside Demonstration District C in Vance County compared to the rest of the voting age population. Dr. Trende supplies this misleading map to support his inaccurate claim

that the way in which Demonstration District C splits Vance County “separates the Black population of Vance County from the White population” (page 39). As discussed below, this statement is empirically untrue.

55. Despite his conceding what he sees to be a shortcoming of choropleth maps (“they don’t reveal populations,” page 27), he uses eleven of them in his report.²⁴ I found that the design of the maps made it significantly harder than it could have been to discern information from them. Rather than list all of the cartographic choices that I would recommend handling differently, I will list questions that arose when I looked at the maps, questions without obvious answers (even to someone who has been designing and scrutinizing maps for decades).

- What exactly do the unshaded (white) areas with the maps represent?
- What does 0% BVAP look like? White? Yellow?
- Is 1% the same shade as 30%?
- Is the color scale stepped (as it appears in the legend) or continuous (as it appears in the map)?²⁵
- What color is 32%? Yellow? The lightest green shown in the legend? In between?
- What would 90% look like if it indeed is present on the map?²⁶

²⁴ A properly equipped researcher could employ some of the more sophisticated varieties of choropleth maps to show magnitude of population as well as racial percentage in the same map. One strategy for doing so is called value-by-alpha coloring. See, e.g., <https://www.axismaps.com/guide/value-by-alpha>

²⁵ If you’re not familiar with this distinction, the chapter “Design Choropleth Colors & Intervals” from the book *Hands-On Data Visualization*, by Jack Dougherty & Ilya Ilyankou, has a good introduction. It’s available online at <https://handsondataviz.org/design-choropleth.html>

²⁶ Answering questions like this one was not made easier by Dr. Trende’s talking about the color scales having been “truncated at 30% and 70% BVAP.”

56. In short, the choropleth maps caused more uncertainty for me than illumination.

57. One of the classic pitfalls in spatial analysis is known as MAUP, for the “modifiable area unit problem,” which has overlap with a related hazard called the ecological fallacy. One phrase summing up the error in reasoning is “the mistaken assumption of social composition at one spatial scale of analysis based on another scale.”²⁷ To use an illustration from politics, if presidential candidate A receives a majority of the national popular vote, that doesn’t necessarily win them the election, because what matters is winning the majority in individual states (i.e., a different scale of measurement). It’s important to choose the most appropriate scale for one’s analysis.

58. Pasquotank County provides another example from North Carolina. The BVAP for the county as a whole is 36.72%. Of its ten census tracts, three (30%) are majority-BVAP. Of its nine precincts, two (22.22%) are majority-BVAP. Of its 989 census blocks, 213 (21.54%) are majority-BVAP. Which is the appropriate scale for this *Gingles* factor one analysis? The first one, i.e. the Black voting age population as a percentage of the overall voting age population of the whole area or district.

59. In both Pasquotank and Vance Counties, Dr. Trende includes statistics measuring the percentage of majority-BVAP census blocks, though it’s not a statistic that is germane for the analysis. The consequence is that he gives an inaccurate impression about the racial consequences of splitting Vance and Pasquotank counties. On page 38, he observes that 79% of the majority-BVAP census blocks in Vance County

²⁷ See <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7151983/>

are in Demonstration District C, but concedes (in a parenthetical that seems to have been partially deleted) that the percentage of Vance County's Black voting age *people* included in the district is significantly lower, 63%.²⁸

60. On page 28, Dr. Trende asserts that "Over 11,000 of those Black residents live at the top of the arm of the district that extends into (and splits) Pasquotank County to take in Elizabeth City." I struggled to understand what "top of the arm of the district" could mean in this context. I could not get to the 11,000 number, let alone above it, even trying several generous interpretations of "top of the arm of the district." For reference, the *entire* Black voting age population of Pasquotank County residing in Demonstration District B is 9,469.

61. There is a similarly worded and similarly non-replicable statement on p. 35, "Over 10,000 of those Black residents live at the top of the arm of the district that extends into (and splits) Vance County." Again I struggled to make sense of what this statement could possibly be referring to. The numbers aren't even close.

62. On page 39, we see a reference to "the odd-looking arm separat[ing] the Black population of Vance County from the White population." Again, I found this description puzzling. Almost 37% of Vance County's Black voting age population is not in Demonstration District C, and it's easy to see in Dr. Trende's Figure 22 (on the same page) that there is a VTD outside of the district with a higher BVAP than two VTDs in the district. In fact I had considered an alternative configuration (i.e., including different VTDS in Vance County) that would have had a higher district BVAP (50.36% instead of

²⁸ In recognition of "Compared to what?" I will note that of the total VAP in the county, 54% is included in Demonstration District C.

50.21%). That configuration, however, would have substantially divided both the City of Henderson and the community of South Henderson. The configuration that I ultimately chose for Demonstration District C keeps South Henderson entirely whole and keeps 97.81% of the City of Henderson’s population in the same district.²⁹

E. Other instances of misleading information in maps

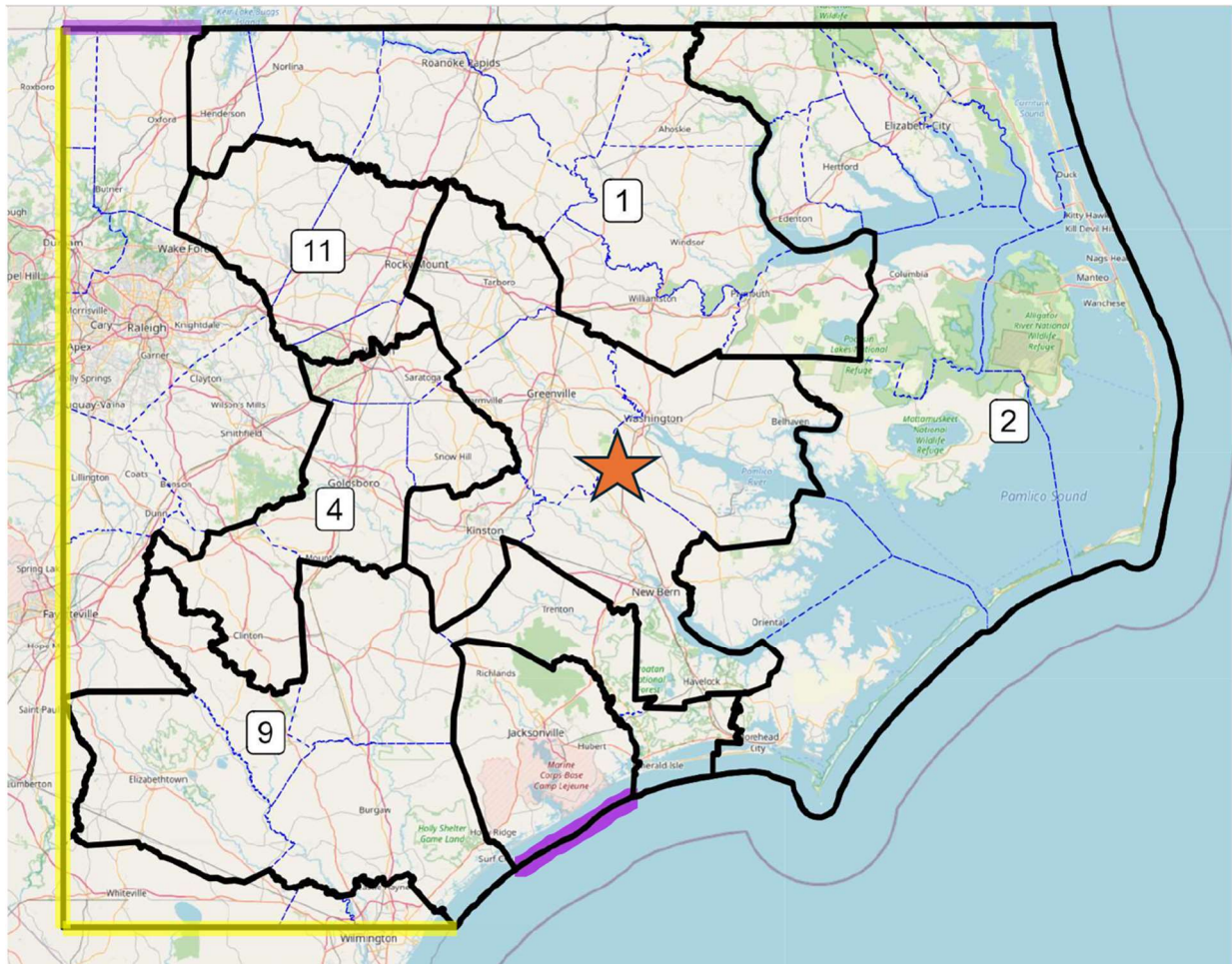
63. Of all 26 maps in Dr. Trende’s report, I find substantial fault with every map except the first one and the last one (and even those have attribution issues). I’ve covered many of those mapping shortcomings in previous subsections, but here are additional cases where information in, or related to, the maps is misrepresented.

64. 15 maps contain lines—sometimes extraneous lines, sometimes fragments of other features—that he presents as district or county lines which don’t in truth exist (Figures 2–7, 10, 13–17, 21–23). What is shown is usually not consistent with his description.³⁰ Figure 6 below shows Dr. Trende’s Figure 4 (page 19) with highlights and markers added. Dr. Trende says that the map “shows the outlines of the [demonstration] districts that are changed from the Enacted Map.” But his black lines show other things, too. Highlighted in yellow are extraneous lines that don’t represent any administrative boundary. Highlighted in purple are district lines, but not ones that are changed from the enacted map. The star marks an area which appears bounded by district lines, but which is not changed (this area could have been differentiated with use of shading—see, e.g., Figure 9 in my previous report).

²⁹ Documentation of alternative configuration provided in **Attachment H**.

³⁰ Dr. Trende demonstrates that it is possible to make maps using his tools without this misstep, e.g., in figures 20 and 26.

Figure 6: Example of map highlighting lines that should have been omitted



65. His depiction of Elizabeth City in Figures 14 and 15 omits the portion of the city in Camden County (pp. 31 and 32).

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed on August 30, 2024.

A handwritten signature in black ink, appearing to read "Blakeman B. Esselstyn".

Blakeman B. Esselstyn

Attachment A

Blakeman ("Blake") B. Esselstyn

United States: 49 North Street · Asheville, NC 28801-1141

The Netherlands: Gaffellaan 11 · 6225KK Maastricht

blake@mapfigure.com · +1 828-338-8528

EDUCATION

- University of Pennsylvania, School of Engineering and Applied Science, Master of Computer and Information Technology, 2003; GPA 4.0
- Yale University, Geology & Geophysics and International Studies, Bachelor of Arts, 1996

PROFESSIONAL CERTIFICATIONS

- Geographic Information Systems Professional (GISP), #6946, 2009
- American Institute of Certified Planners (AICP), #026364, 2013

EMPLOYMENT (Teaching positions listed separately)

- Redistricting Consultant, dba Mapfigure Consulting (and as Blake Esselstyn), Asheville, NC, 2016–present (and in the Netherlands starting late 2022)
- Principal Consultant, FrontWater, LLC, Asheville, NC, 2015–present
- Urban Planner III – GIS Specialist, City of Asheville Department of Planning and Urban Design, Asheville, NC, 2008–2015
- Urban Planner II, City of Asheville Planning Department, Asheville, NC, 2004–2008
- Independent GIS Consultant, Freelance, Asheville, NC, 2003–2004
- GIS Programmer, Azavea, Inc., Philadelphia, PA, 2002
- Web Support Fellow, University of Pennsylvania, Philadelphia, PA, 2002
- GIS Analyst, Applied Geographics, Inc., Boston, MA, 2001
- GIS Intern, Community and Environmental Spatial Analysis Center, Seattle, WA, 2000
- GIS Analyst, Applied Geographics, Inc., Boston, MA, 2000
- Mapping Technician, Schlosser Geographic Systems, Seattle, WA, 1997
- Digital Mapping Resources Consultant, Social Science Statistical Laboratory at Yale University, New Haven, CT, 1997
- Special Assistant to the CityRoom Coordinator, Neighborhood Partnerships Network, New Haven, CT, 1996–1997

- Lab Monitor, Center for Earth Observation at Yale University, New Haven, CT, 1995

TEACHING EMPLOYMENT

- Adjunct Faculty, Lenoir-Rhyne University, Asheville, NC, 2019
Taught full-semester graduate-level Geographic Information Systems (GIS) course
- Adjunct Faculty, Western Carolina University, Asheville, NC, 2017
Taught full-semester graduate-level GIS course
- GIS Course Assistant, University of Pennsylvania, Philadelphia, PA, 2002–2003
Served as teaching assistant for two undergraduate GIS semester courses
- Teacher, Equity American School, Guatemala City, Guatemala, 1998–1999
Led mathematics department for grades 7–12; taught one technology course
- Teacher, International School of Panama, Panama City, Republic of Panama, 1997–1998
Taught computer programming and mathematics to secondary school students

LITIGATION EXPERIENCE (As GIS and/or redistricting expert)

- Preparation of expert report for plaintiffs, in *Pierce v. North Carolina State Board of Elections*, U.S District Court for the Eastern District of North Carolina, 2023–2024
- Testifying expert for plaintiffs, in *Grant v. Raffensperger*, U.S District Court for the Northern District of Georgia, 2022–2023
- Consulting expert for plaintiffs, in *League of United Latin American Citizens v. Abbott*, U.S District Court for the Western District of Texas, 2022
- Consulting expert for plaintiffs, in *Rivera v. Schwab*, Wyandotte County (KS) District Court, 2022
- Consulting expert for plaintiffs, in *Harper v. Lewis*, Wake County (NC) Superior Court, 2019
- Consulting expert for plaintiffs, in *Common Cause v. Lewis*, Wake County (NC) Superior Court, 2019
- Preparation of redistricting map exhibits used in *Vesilind v. Virginia State Board of Elections*, Richmond (VA) Circuit Court, 2017
- Expert witness analysis, deposition, and testimony for City of Asheville, in *Jensen v. City of Asheville*, Buncombe County (NC) Superior Court, 2009–2010
- Expert witness analysis and testimony for City of Asheville, in *Hall v. City of Asheville*, Buncombe County (NC) Superior Court, 2007
- Expert witness analysis and testimony for City of Asheville, in *Arnold v. City of Asheville*, Buncombe County (NC) Superior Court, 2005

PUBLIC REDISTRICTING PROJECT EXPERIENCE

- Design of electoral redistricting plans for Edgecombe County (NC) Board of Education, 2024 (adoption expected in late 2024 or early 2025)
- Design and completion of adopted electoral redistricting plans for Watauga County (NC) Board of Commissioners, 2024
- Design and completion of adopted electoral redistricting plans for Buncombe County (NC) Board of Education, 2023–2024
- Design and completion of adopted electoral redistricting plans for Wake County (NC) Board of Education, 2021–2022
- Design and completion of adopted electoral redistricting plans for Mecklenburg County (NC) Board of Commissioners, 2021
- Design and completion of adopted electoral redistricting plans for Craven County (NC) Board of Commissioners, 2021
- Design and completion of adopted electoral redistricting plans for City of Fayetteville (NC) City Council, 2021
- Design and completion of adopted electoral redistricting plans for City of Greenville (NC) City Council, 2021
- Design and completion of adopted electoral redistricting plans for Town of Cary (NC) Town Council, 2021
- Design and completion of adopted electoral redistricting plans for City of Hickory (NC) City Council, 2021
- Design and completion of adopted electoral redistricting plans for Town of Mooresville (NC) Board of Commissioners, 2021
- Design and completion of adopted electoral redistricting plans for City of Clinton (NC) City Council, 2021
- Design and completion of adopted electoral redistricting plans for Siler City (NC) Board of Commissioners, 2021
- Design and completion of adopted electoral redistricting plans for Town of Tarboro (NC) Town Council, 2021
- Design and completion of adopted electoral redistricting plans for Durham Public Schools (NC) Board of Education, 2021
- Design and completion of adopted electoral redistricting plans for Pitt County (NC) Board of Education, 2021
- Design and completion of adopted electoral redistricting plans for Union County (NC) Board of Education, 2021

- Design and completion of adopted electoral redistricting plans for Edgecombe County (NC) Board of Education, 2021
- Design and completion of adopted electoral redistricting plans (in advance of Census data delivery) for Town of Cary (NC) Town Council, 2021
- Lead presenter, Lenoir-Rhyne University Hands-on Redistricting Workshop, Virtual, 2021
- Software operator and presenter, National Conference of State Legislatures Redistricting Seminar: Redistricting Simulation, Columbus, OH, 2019
- Software operator and presenter, National Conference of State Legislatures Redistricting Seminar: Redistricting Simulation, Providence, RI, 2019
- Hands-on GIS software workshop session leader, Metric Geometry of Gerrymandering Group (MGGG) Conference at the University of Texas, Austin, TX, 2018
- Co-leader of redistricting hackathon, Metric Geometry of Gerrymandering Group (MGGG) Conference at Duke University, Durham, NC, 2017
- Preparation of simulated redistricting plans for Democracy North Carolina's Districting Voter Education Forum, Asheville, NC, 2017
- Hands-on GIS software workshop session assistant, Metric Geometry of Gerrymandering Group (MGGG) Conference at Tufts University, Medford, MA, 2017
- Redistricting software operator (converting retired jurists' instructions into maps), Duke University and Common Cause NC independent redistricting commission simulation, Raleigh, NC *and* Winston-Salem, NC, 2016

SPEAKER OR PANELIST

- "How Open Source Geo Tools Could Shape (Some) American Elections" Closing Keynote, FOSS4G (Free and Open Source Software for Geospatial) Conference Belgium + Netherlands, Baarle-Hertog, Belgium, 2024 [Scheduled]
- "Politics and QGIS: Open Source Legislative Reapportionment," QGIS User Conference, Den Bosch, The Netherlands, 2023
- "Political Reapportionment: Drawing Boundaries with QGIS," FOSS4G (Free and Open Source Software for Geospatial) Conference, Florence, Italy, 2022
- "Just Maps: How Gerrymandering Imperils the Right to Vote," Osher Lifelong Learning Institute at the University of North Carolina Asheville, virtual, 2022
- "How to Be a Redistricting Watchdog," Duke University's Redistricting and American Democracy Conference, Durham, NC, 2021
- "North Carolina Redistricting with Geographers: Local Knowledge & Community Considerations," American Association of Geographers (AAG) Redistricting Panel Series, Virtual, 2021

- “The Basics of Redistricting for Local Governments,” NC Council of School Attorneys Summer Law Conference, Virtual, 2021
- “Census Timing and Redistricting,” UNC School of Government: Municipal Attorneys’ Winter Conference, Virtual, 2021
- “Census Delays and Redistricting,” North Carolina League of Municipalities Online Meeting, Virtual, 2021
- “Redistricting: Ten Big Changes that GIS People Should Know About for 2021,” North Carolina GIS Conference, Virtual, 2021
- “Demographics, the Census, and a Bit about Redistricting,” UNC School of Government: County Attorneys Conference, Virtual, 2021
- “NC Redistricting Updates for the GIS Community,” Mountain Region GIS Alliance, Virtual, 2021
- “The Census and Demographics,” UNC School of Government: Redistricting for Local Governments Conference, Virtual, 2021
- “The Mechanics of Redistricting,” UNC School of Government: Redistricting for Local Governments Conference, Virtual, 2021
- “Ask the Experts Panel,” National Conference of State Legislatures (NCSL) Redistricting Seminar, Virtual, 2021
- “GIS and the Data Handoff,” National Conference of State Legislatures (NCSL) Redistricting Seminar, Virtual, 2021
- “Electoral Redistricting for School Boards after the 2020 Census,” North Carolina School Boards Association 2020 Annual Conference, Virtual, 2020
- “Redistricting Software 2021: The Next Generation of Tools Could Open New Doors,” Urban and Regional Information Systems Association (URISA) GIS-Pro Conference, Virtual, 2020
- “Changing Demographics, Drawing Districts, and County Impacts,” North Carolina Association of County Commissioners 113th Annual Conference, Virtual, 2020
- “QGIS and democracy: Redistricting and reapportionment with QGIS,” QGIS North America Conference, Virtual, 2020
- “Does Your Vote Count?: The Impact of Gerrymandering,” virtual panel hosted by League of Women Voters Asheville Buncombe, NC, 2020
- [Scheduled, but cancelled due to COVID-19] “Redistricting with QGIS,” Free and Open Source Software for Geospatial Conference, Calgary, Alberta, Canada, 2020
- [Scheduled, but cancelled due to COVID-19] Teaching Faculty (session title to be determined), National Conference of State Legislatures Redistricting Seminar, Las Vegas, NV, 2020

- [Scheduled, but cancelled due to COVID-19] “Census Geography, Precision, & Privacy,” Census Symposium, University of North Carolina Asheville, NC, 2020
- “The State of Redistricting Software and Data Resources for 2020,” Quantitative Investigations of Gerrymandering and Redistricting Conference, Duke University, Durham, NC, 2020
- “School Board Elections,” 53rd School Attorneys’ Conference, UNC School of Government, Chapel Hill, NC, 2020
- “Methods and Techniques in Redistricting,” Harvard Geography of Redistricting Conference, Cambridge, MA, 2019
- “Redistricting Software: A new generation of geospatial tools,” North Carolina GIS Conference, Winston-Salem, NC, 2019
- “The Latest Mapping Technology,” Reason, Reform & Redistricting Conference, Duke University, Durham, NC, 2019
- “Redistricting—What Happens Now?” Voter Education Panel hosted by League of Women Voters (and others), Hendersonville, NC, 2019
- “What are all These Districts? How did We Get Here, and Redistricting Reform,” Grassroots Democracy: A Nonpartisan Voter Education Series, Leicester, NC, 2019
- “Re-GIS-tracting? A new generation of redistricting geo-tools,” Mountain Region GIS Alliance, Asheville, NC, 2019
- “Representing (mis)representation,” Tapestry Data Storytelling Conference, University of Miami, Miami, FL, 2018
- “A Redistricting Tour,” Democracy in our Hands Conference, Asheville, NC, 2018
- “Dis-tricks: GIS and Public Understanding of Redistricting,” NC ArcGIS Users Group, Asheville, NC, 2018
- “Visual Explanations of Gerrymandering,” Highlands Indivisible, Highlands, NC, 2018
- “Dave’s Redistricting App,” Metric Geometry of Gerrymandering Workshop, University of Texas, Austin, TX, 2018
- “Districting Voter Education Forum,” Democracy North Carolina, Asheville, NC, 2017
- “When GIS leads planners astray,” American Planning Association National Conference, New York, NY, 2017
- “Conveying Uncertainty with GIS,” Azavea, Philadelphia, PA, 2017
- “GISkepticism,” Appalachian State University, Boone, NC, 2017
- “When GIS leads planners astray,” North Carolina Planning Conference, American Planning Association North Carolina Chapter, Asheville, NC, 2016

- “What if the ‘S’ in GIS stood for Skepticism?” Mountain Region GIS Alliance, Asheville, NC, 2015
- “Open Data? Show Me the Money!” North Carolina GIS Conference, Raleigh, NC, 2015

TEACHING AS SINGLE-CLASS GUEST SPEAKER (On redistricting and/or GIS)

- United World College Maastricht, Geography Course (speaking on GIS), 2024
- Lenoir-Rhyne University, Public Policy Course (speaking on redistricting and representation), 2021
- Lenoir-Rhyne University, Geographic Information Systems Course (speaking on GIS), 2021
- University of North Carolina Asheville, Mathematics: Voting Theory Course (speaking on redistricting), 2020
- Metric Geometry and Gerrymandering Group Redistricting Lab (Tufts University + MIT), Geodata Bootcamp Mapmaking Session (speaking on redistricting software), 2020
- [Scheduled, but cancelled due to COVID-19] Duke University, Law School: Election Law Course (leading hands-on redistricting simulation exercise), April 2020
- Duke University, Data Science Capstone Seminar (speaking on data science professional/career advice), 2020
- University of North Carolina Asheville, Political Science: Census Course (speaking on redistricting), 2020
- Lenoir-Rhyne University, Public Policy Course (speaking on redistricting), 2019
- Western Carolina University, Geographic Information Systems Course (speaking on GIS), 2019
- Duke University, Democracy Lab Seminar (speaking on redistricting software tools), 2018
- University of North Carolina Asheville, Political Science: US Elections Course (speaking on redistricting), 2018
- University of North Carolina Asheville, Mathematics: Voting Theory Course (speaking on redistricting), 2018
- Lenoir-Rhyne University, Sustainability Management & Decision-Making Course (speaking on GIS/location intelligence), 2018
- Yale University, School of Organization and Management: Business Information Course (speaking on Maptitude—one class + multiple labs), 1997

MEDIA APPEARANCES, OP-EDS, AND CITATIONS

- “Gerrymandered or no? How will courts judge new North Carolina political maps?” *Raleigh News & Observer*, February 8, 2022
- “Monster: Math, maps and power in North Carolina,” special podcast series from *Raleigh News & Observer*, September 24, 2021
- “Census data has arrived. What comes next?” *Chatham News + Record*, September 1, 2021
- “An Explainer for Redistricting Criteria, Part 1: Political Boundaries,” *John Locke Foundation*, August 23, 2021
- “Special report: Demystifying the redistricting process,” *NC Policy Watch*, August 20, 2021
- “Raleigh, Cary and other NC cities may have to push back their 2021 elections,” *Raleigh News & Observer*, February 24, 2021
- “Triad Cities Awaiting Census Data May Delay Elections,” WFDD Radio, February 17, 2021
- Live interview, WPTF Radio Afternoon News, February 15, 2021
- “Census Delays Could Delay Charlotte City Council, CMS Fall Elections,” WFAE Radio, January 28, 2021
- “What do Buncombe's new district lines mean for 2020 commissioner elections?” (map citation), *Asheville Citizen-Times*, November 21, 2019
- “Confused about new legislative districts? This ‘map geek’ can help,” *NC Policy Watch*, November 21, 2019
- “Which district are you in? After gerrymandering fight, Asheville, Buncombe get final state districts,” *Asheville Citizen-Times*, November 4, 2019
- “Suggestions for a fair redistricting process,” *Princeton Election Consortium*, September 16, 2019
- “How will Asheville, Buncombe County be affected by gerrymandering decision?” *Asheville Citizen-Times*, September 6, 2019
- “2019 Districting,” JMPRO TV's *The Weekly Update*, September 1, 2019
- “As redistricting battle continues in NC, League of Women Voters holds panel,” *WLOS-TV*, August 11, 2019
- “With No Supreme Court End to Gerrymandering, Will States Make It More Extreme?” (citation/link of blog article), *New York Times*, June 28, 2019
- “The Supreme Court takes on gerrymandering. A cottage industry wants to prove it's gone too far,” *USA Today*, March 26, 2019
- “Gerrymandering: 'Packing' and 'Cracking,' the meat and potatoes of partisan redistricting,” *USA Today*, March 25, 2019

- “NC gerrymandering: Turner, McGrady lead reform effort on redistricting,” *Asheville Citizen-Times*, February 14, 2019
- “Looking for a Way Forward on Redistricting Reform,” *Duke Today*, January 28, 2019
- “Will Asheville try to stop the state from splitting it into districts?” (map citation), *Asheville Citizen-Times*, January 23, 2019
- “Some takeaways from NC’s elections,” WRAL.com, Nov 7, 2018
- “New Asheville districts are racial gerrymandering, black council members say” *Asheville Citizen-Times*, July 2, 2018
- “Legislature sets up districts for Asheville council, eliminates primaries” (map citation), *Asheville Citizen-Times*, June 27, 2018
- “Van Duyn to back Asheville council districts bill if Senate shifts election dates” (map citation), *Asheville Citizen-Times*, June 21, 2018
- “I Ran the Worst 5K of My Life So I Could Explain Gerrymandering to You,” *POLITICO Magazine*, November 15, 2017
- “Event to cover Nov. vote on City Council districts,” *Asheville Citizen-Times*, October 17, 2017
- “Republicans silent in wake of court order to draw new maps in one month,” *NC Policy Watch*, August 2, 2017
- “Who makes the grade? This week’s editorial report card,” *Asheville Citizen-Times*, June 2, 2017
- “Asheville grows; Charlotte, Raleigh and their suburbs grow faster,” *Asheville Citizen-Times*, May 29, 2017
- “Boundary issues: Where does Asheville end?” (op-ed), *Mountain Xpress*, April 29, 2016
- “For better or worse, Asheville growth inevitable,” *Asheville Citizen-Times*, November 21, 2015
- “St. Lawrence Green no litmus test for voters” (op-ed), *Mountain Xpress*, October 29, 2015

PUBLISHED WORK

- “Redistricting Software Applications, Data, and Related Tools,” supplement to *Redistricting: A Guide for the GIS Community*, Urban and Regional Information Systems Association, 2021
- (Co-authored with Mark Salling, PhD, GISP) “GIS Software Functionality for Redistricting,” *The GIS Professional*, Issue 301, Urban and Regional Information Systems Association, May/June 2021
- (Co-authored with Joan Gardner, Suzanne Rotwein, and Tong Zhang) “Integrating GIS and Social Marketing at HCFA,” *ESRI Map Book*, Volume 16, ESRI Press, 2001

SELF-PUBLISHED PUBLIC-FACING EXPLANATORY WRITING & MAPS

- (Co-authored with Christopher Cooper, Gregory Herschlag, Jonathan Mattingly, Rebecca Tippet) “NC General Assembly County Clusterings from the 2020 Census,” *Quantifying Gerrymandering* Blog, August 17, 2021
- (Co-authored with Christopher Cooper, Gregory Herschlag, Jonathan Mattingly, Rebecca Tippet) “Legislative County Clustering in North Carolina—Looking towards the 2020 Census,” *Quantifying Gerrymandering* Blog, July 16, 2021
- Created the blogs at districks.com (2017) and mapfigure.com (2020) — the story maps “A ‘Stephenson’ explainer” and “Could COVID repercussions delay NC elections in 2021 & 2022?” have each been viewed more than 2,000 times.

REDISTRICTING AND GIS SOFTWARE EXPERIENCE

- MapInfo (first used 1996)
- Maptitude (first used 1997)
- Esri ArcGIS/ArcInfo/ArcView (first used 2000)
- QGIS (first used 2015)
- Maptitude for Redistricting (first used 2016)
- Dave’s Redistricting App (first used 2016)
- DistrictBuilder (first used 2017)
- Esri Redistricting (first used 2018)
- Districtr (first used 2019)
- Statto Software Redistricter (first used 2019)
- ArcBridge DISTRICTSolv (first used 2020)

SELECTED AWARDS (As team member)

- G. Herbert Stout Award for Visionary use of GIS by Local Government, 2009
- International Economic Development Council, Excellence in New Media Initiatives, 2008
- Marvin Collins Outstanding Planning Award for Innovations in Planning Services, Education, and Public Involvement, 2007

SERVICE AS ELECTION OFFICIAL

- Poll worker for multiple elections in Buncombe County, North Carolina (2012, 2020, 2022) and King County, Washington (2000), including as Chief Precinct Judge in 2020 general election and 2022 primary election

SERVICE ON BOARDS AND COMMISSIONS

- Asheville City Council Appointee to Comprehensive Plan Advisory Committee, 2016–2018

ADDITIONAL TRAINING

- Introduction to GIS for Equity and Social Justice, Urban and Regional Information Systems Association Certified Workshop, Virtual, 2020
- Public Data, Public Access, Privacy, and Security: U.S. Law and Policy, Urban and Regional Information Systems Association Certified Workshop, Raleigh, NC, 2015
- An Overview of Open Source GIS Software, Urban and Regional Information Systems Association Certified Workshop, Portland, OR, 2012
- An Introduction to Public Participation GIS: Using GIS to Support Community Decision Making, Urban and Regional Information Systems Association Certified Workshop, Orlando, FL, 2010
- 3-D Geospatial Best Practices and Project Implementation Methods, Urban and Regional Information Systems Association Certified Workshop, Vancouver, BC (Canada), 2006

MEMBERSHIPS

- Urban and Regional Information Systems Association (URISA)
- Mountain Region GIS Alliance (MRGAC)
- American Planning Association (APA)

Attachment B

Data sources, software, and methodology

1. One important source of data for this report was the United States Census Bureau, whose resources are made available to the public via its website (<https://www.census.gov>). This federal agency produces a) geographic files—e.g., county boundaries and block boundaries, b) tables of the block-level demographic information yielded specifically for redistricting (sometimes referred to as the PL 94-171 data) from the decennial census counts, c) “block assignment files,” which are important for linking geography data to other data, and d) special tabulations of data from the American Community Survey (ACS) which include information on topics like citizenship. Representative links for these four categories of data are provided below:

- a) <https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.2020.html>
- b) <https://data.census.gov/cedsci/all?q=&y=2020&d=DEC%20Redistricting%20Data%20%28PL%2094-171%29>
- c) <https://www.census.gov/geographies/reference-files/time-series/geo/block-assignment-files.html>
- d) <https://www.census.gov/programs-surveys/decennial-census/about/voting-rights/cvap.html>

2. Another key source of information for the analysis was the North Carolina General Assembly’s Legislative and Congressional Redistricting webpage, available at <https://www.ncleg.gov/Redistricting>. This webpage provided links to representations of the enacted State Senate plans, as well as statistical reports for the plans and the October 2023 Senate Plan Criteria document.

3. To tabulate citizen voting age population totals for the CVAP statistics in this report, I used a dataset released by the Redistricting Data Hub (RDH) on June 24, 2024. The RDH utilizes the CVAP special tabulation from the U. S. Census Bureau’s American

Community Survey referenced in 1.d) above and disaggregates the block group level data to the block level. The report itself provides more details about the use of this dataset. The dataset can be found at <https://redistrictingdatahub.org/dataset/north-carolina-cvap-data-disaggregated-to-the-2020-block-level-2022/> and the methodology used to produce it can be found at https://redistrictingdatahub.org/wp-content/uploads/2024/06/readme_nc_cvap_2022_2020_b_csv.txt

4. One software application I used in the analysis of maps and the creation of the demonstration districts is *Maptitude for Redistricting*, produced by the Caliper Corporation. This specialized geographic information system (GIS) software facilitates the installation, interconnecting, and synthesis of Census Bureau data files. It allows for an existing redistricting plan to be imported (like the enacted plans from the North Carolina General Assembly), or plans can be created and edited starting from a blank template. The application generates not only the aggregated statistics for each of the created districts, but also can supply customized maps and overall reports on overall characteristics of the plan like average district compactness and population deviation. *Maptitude for Redistricting* is widely used by state and local governments for redistricting and is in fact used by the North Carolina General Assembly.

5. Another software application that was useful as a supplemental tool is an open-source GIS software package called *QGIS*. My primary use of *QGIS* was for the production of Figure 1 and Figure 3. For creating custom map illustrations, *QGIS* enables me to take geographic files exported from *Maptitude for Redistricting* or downloaded from the North Carolina General Assembly or the U. S. Census Bureau and create high-resolution graphics for insertion into the document with myriad options for presentation of visual elements. Additionally, *QGIS* offers modules that provide

redistricting features similar to the functionality of *Maptitude for Redistricting* described above, though not as extensive.

6. I also used software called *DRA 2020*, a web-based tool which includes multiple categories of pre-loaded census data and allows for the review, creation, and editing of redistricting plans. Please note that when I used *DRA 2020*, I always used it in the “Hide Election Data and Partisan Analytics” mode.

7. I used *Microsoft Excel* for preparation of spreadsheets and for some statistical calculations.

8. I used *Microsoft PowerPoint* for preparation of selected graphics.

9. I used *Microsoft Notepad* for reviewing R code files.

10. I did not use or consult any data relating to election results, partisan advantage, or voter registration as part of my process. Clarification: I did reference the “stat pack” published by the North Carolina General Assembly for the recently enacted Senate plan, and that stat pack includes election information, but I avoided looking at those sections.

Attachment C

Citizen Voting Age Population (CVAP) Statistics

All calculated using RDH block-level dataset based on 2018–2022 ACS special tabulation

Enacted 2022 Senate Relevant Eastern Districts

District ID	Total CVA Pop	Black CVA Pop	Black CVAP %
1	160,505	28,662	17.86%
3	157,195	68,010	43.26%
4	158,105	58,246	36.84%
5	167,020	67,649	40.50%
9	148,706	37,728	25.37%
11	155,240	60,207	38.78%

Enacted 2023 Senate Relevant Eastern Districts

District ID	Total CVA Pop	Black CVA Pop	Black CVAP %
1	158,230	47,691	30.14%
2	159,470	48,981	30.71%
4	158,105	58,246	36.84%
5	167,020	67,649	40.50%
9	148,706	37,728	25.37%
11	155,240	60,207	38.78%

Demonstration Map A

District ID	Total CVA Pop	Black CVA Pop	Black CVAP %
A	156,100	82,280	52.71%
A-2	163,264	29,464	18.05%
A-4	151,216	54,156	35.81%
A-9	153,151	31,102	20.31%
A-11	156,020	55,851	35.80%

Demonstration Map B

District ID	Total CVA Pop	Black CVA Pop	Black CVAP %
B	157,022	77,588	49.41%
B-2	160,678	19,084	11.88%

Demonstration Map C

District ID	Total CVA Pop	Black CVA Pop	Black CVAP %
C	160,982	82,488	51.24%
C-2	173,415	23,951	13.81%
C-4	145,644	55,731	38.27%
C-11	151,004	52,955	35.07%

Demonstration Map D

District ID	Total CVA Pop	Black CVA Pop	Black CVAP %
D	157,457	78,952	50.14%
D-2	160,243	17,720	11.06%

Demonstration Map E

District ID	Total CVA Pop	Black CVA Pop	Black CVAP %
E	157,159	79,746	50.74%
E-2	160,541	16,926	10.54%

Attachment D

User: Blake Esselstyn

Plan Name: Demonstration Map E

Plan Type: NC Senate

Population Summary

Saturday, August 31, 2024

1:36 AM

District	Population	Deviation	% Devn.	[% AmIndian]	[% Asian]	[% AP_Blkl	[% Hispanic Origin]	[% White]	[% 18+ _AP_Blkl
E	199,064	-9,724	-4.66%	1.67%	0.53%	50.93%	3.97%	42.88%	49.64%
E-2	199,116	-9,672	-4.63%	0.43%	0.79%	10.77%	4.75%	81.45%	10.08%

Total Population: 398,180

Ideal District Population: 208,788

Summary Statistics:

Population Range: 199,064 to 199,116

Ratio Range: 0.00

Absolute Range: -9,724 to -9,672

Absolute Overall Range: 52

Relative Range: -4.66% to -4.63%

Relative Overall Range: 0.02%

Absolute Mean Deviation: 9,698.00

Relative Mean Deviation: 4.64%

Standard Deviation: 26.00

Attachment E

Measures of Compactness Report

Saturday, August 31, 2024

1:40 AM

	Reock	Polsby-Popper
Sum	N/A	N/A
Min	0.30	0.17
Max	0.34	0.21
Mean	0.32	0.19
Std. Dev.	0.03	0.03
District	Reock	Polsby-Popper
E	0.30	0.21
E-2	0.34	0.17

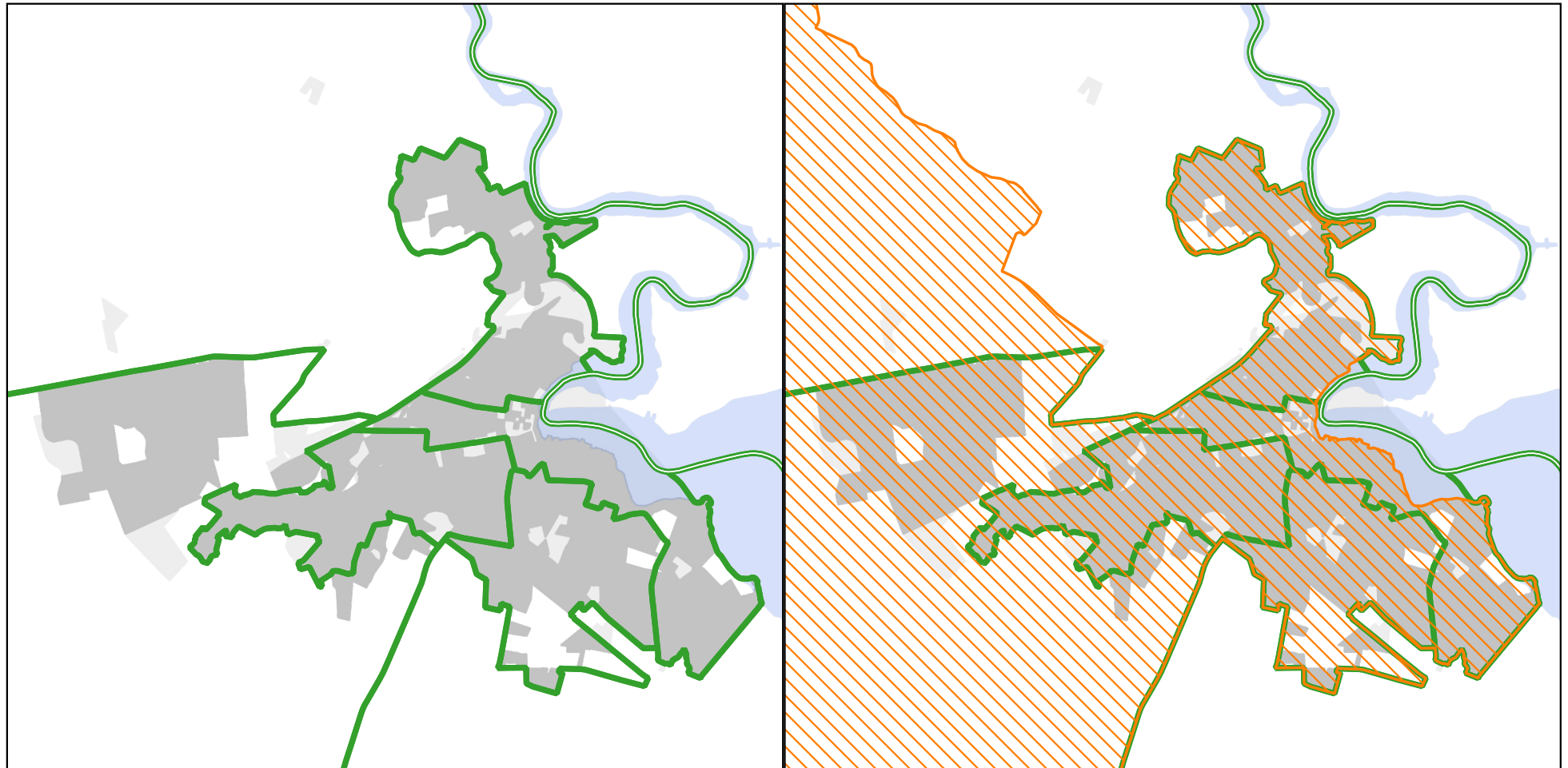
Measures of Compactness Summary

Reock	The measure is always between 0 and 1, with 1 being the most compact.
Polsby-Popper	The measure is always between 0 and 1, with 1 being the most compact.

Attachment F

Elizabeth City Precincts

with Demonstration District E



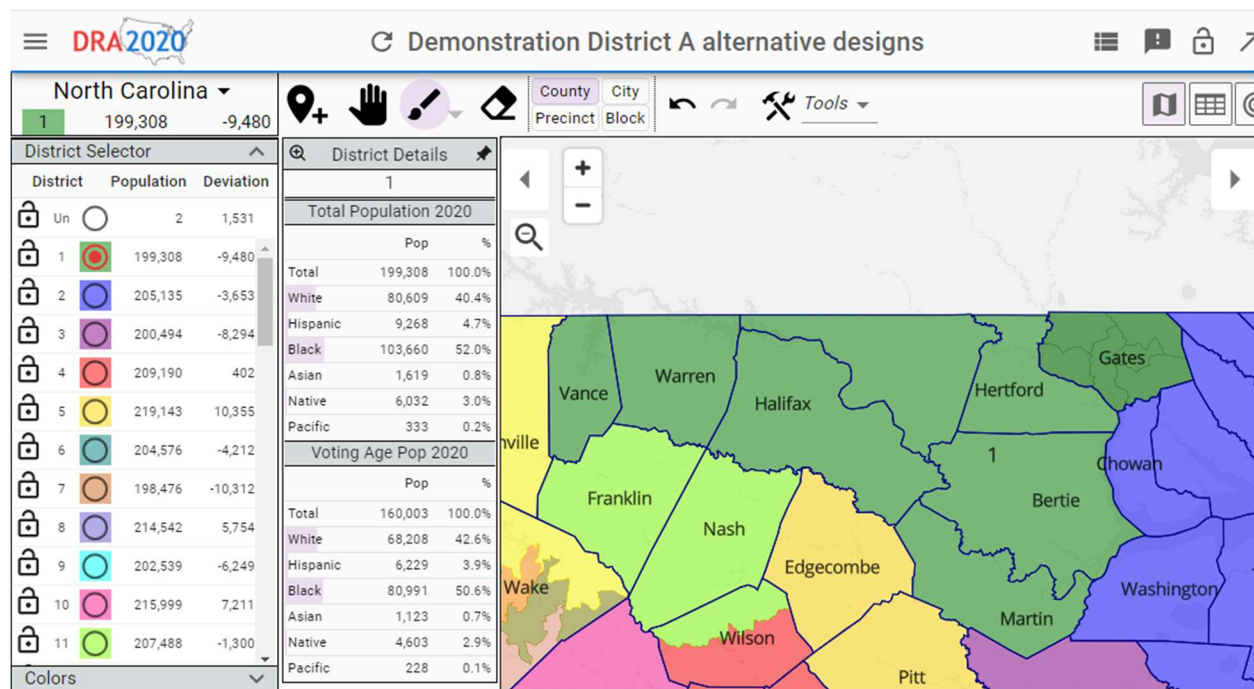
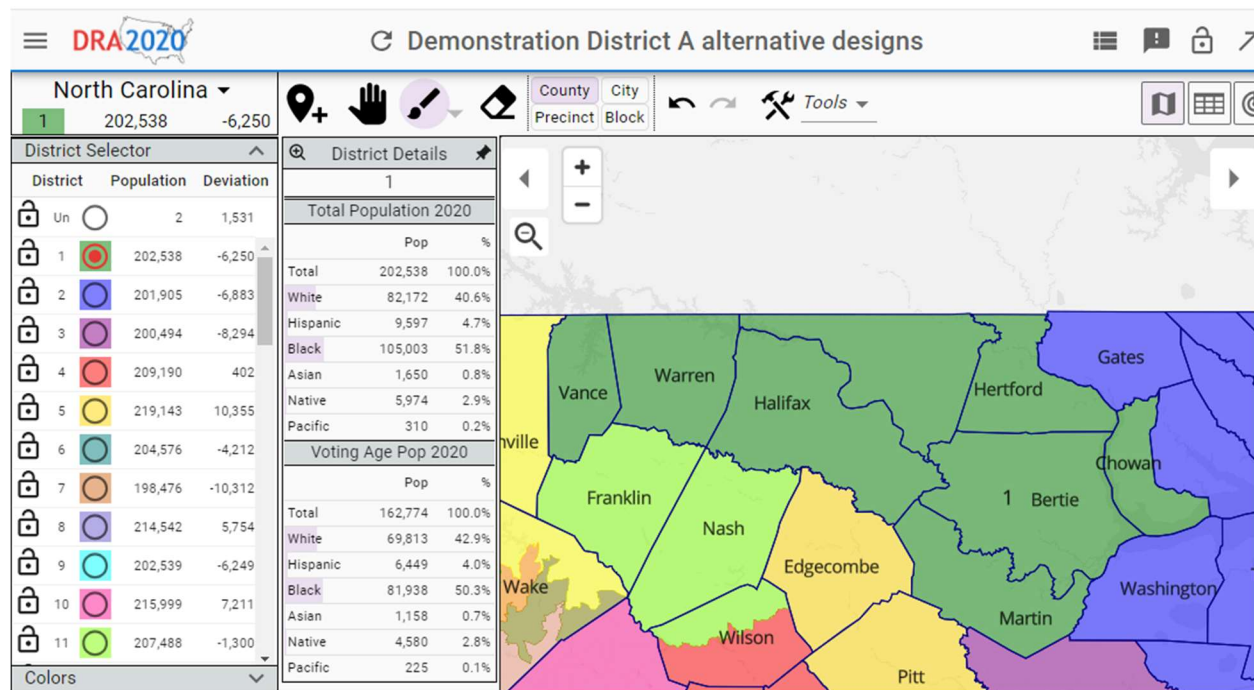
- Elizabeth City land area
- Elizabeth City populated blocks (within Pasquotank County)
- Precinct boundaries
- Demonstration District E
- County Boundary
- Pasquotank River



Attachment G

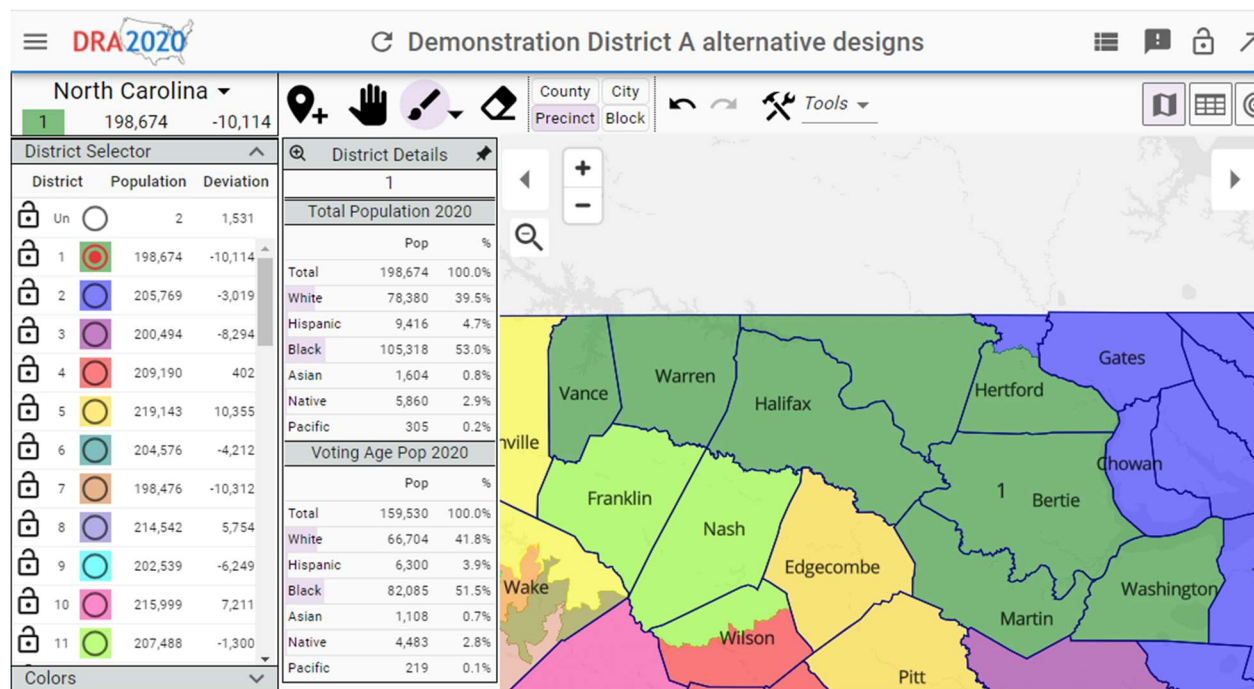
Alternative majority-Black configurations for Demonstration District A
(note the percentage of Black Voting Age Population)

First, with Chowan or Gates Counties instead of Washington:

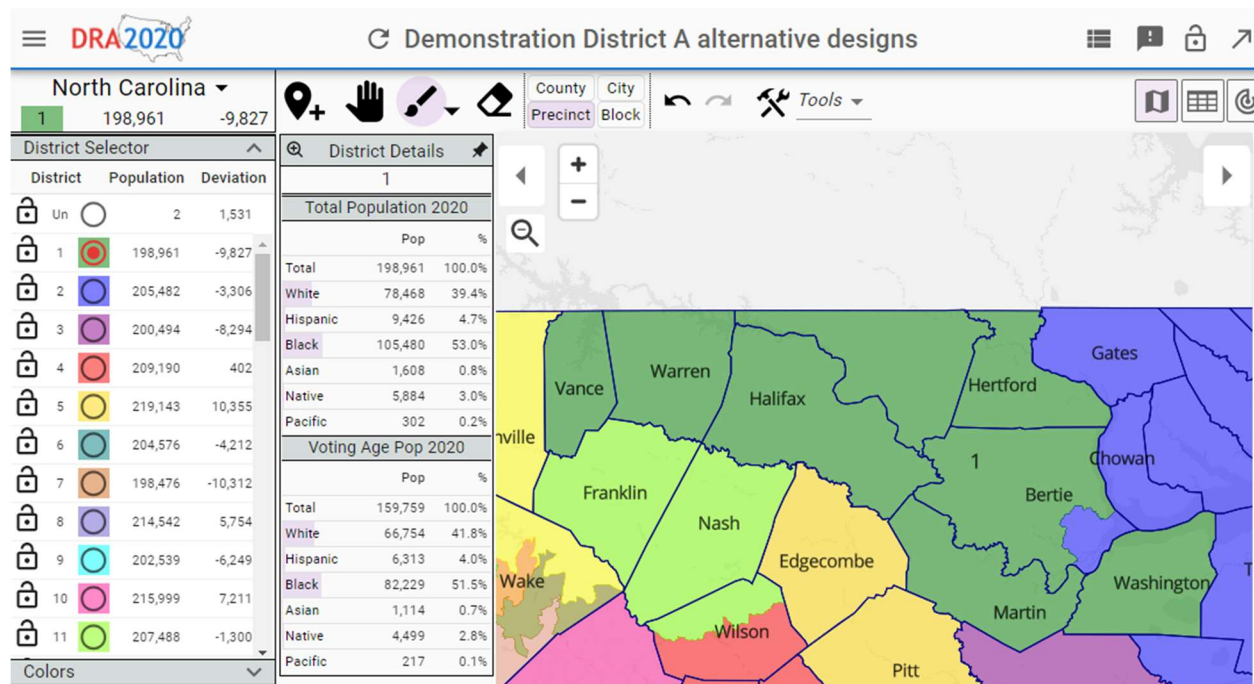


Second, it is possible to remove precincts other than those specified by Dr. Trende.

Two precincts removed from Hertford County:



Precinct removed from Bertie County:



Attachment H

Alternative configuration for Demonstration District C
(considered but not chosen)

